Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

11-AMCP-0138

MAY 16 2011

Ms. J. A. Hedges, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port off Benton Boulevard
Richland, Washington 99354

Dear Ms. Hedges:

LAND DISPOSAL RESTRICTIONS VARIANCE REQUEST

This letter transmits a site-specific Land Disposal Restrictions (LDR) variance request to address the one-time treatment and disposal of a highly radioactive cemented waste stream also designated as D006, D007, and D008. The cemented mixed low-level waste (MLLW) is currently stored in the Central Waste Complex. The treatment of this cemented MLLW for the characteristic metals to meet the applicable concentration based treatment standards is inappropriate given the radiological characteristics of the waste. There are no onsite or offsite treatment facilities capable of accepting the waste for treatment to meet the concentration based standards. A variance from the required LDR treatment standards for D006, D007, and D008 is requested to allow LDR treatment via macroencapsulation of the characteristic metals.

The State of Washington Department of Ecology (Ecology) regulations allow for site-specific LDR variances provided there is sufficient justification and the alternative is just as, or more, protective of human health and the environment. The attached petition provides information required by Ecology regulations.

If you have any questions, please contact me, or your staff may contact Jonathan Dowell, Assistant Manager for the Central Plateau, on (509) 373-9971.

Sincerely,

Matt McCormick
Manager

AMCP:MSC

Attachment

cc: See page 2

cc w/attach:
G. Bohnee, NPT
L. Buck, Wanapum
D. A. Faulk, EPA
S. Harris, CTUIR
R. Jim, YN
K. Niles, ODOE
Administrative Record
Environmental Portal

cc w/o attach:
D. G. Black, CHPRC
R. L. Cattlow, CHPRC
M. T. Jansky, CHPRC
R. E. Piippo, MSA
J. G. Vance, MSA

Petition for a Site Specific Land Disposal Restrictions Treatment Variance for Cadmium, Chromium, and Lead in Cemented Mixed Waste

The following is a petition for a site-specific variance to a land disposal prohibition submitted pursuant to Washington Administrative Code (WAC) 173-303-140(2)(a), which incorporates 40 CFR 268.44(h) by reference. This petition proposes an alternative treatment standard for cemented mixed waste (MW) designating for D006, D007, and D008. The following sections address the requirements for petitions stated in WAC 173-303-910.

Identification of Petitioner

Petitioner's Name and Address:	U. S. Department of Energy – Richland Operations Office P. O. Box 550 MSIN A7-50 Richland, Washington 99352 (509) 376-7395
For Technical Information:	M. S. Collins U. S. Department of Energy – Richland Operations Office P. O. Box 550 MSIN A6-38 Richland, Washington 99352 (509)-376-6536
Facility's EPA/State Identification Number:	WA7890008967
Facility Name and Address:	Hanford Site, 200 West Area Central Waste Complex Richland, Washington 99352

Petitioner's Interest in the Proposed Action

The U. S. Department of Energy – Richland Operations Office (DOE-RL) is interested in the final disposition of 126 gallons (0.48 m^3) of highly radioactive cemented MW designating for D006, D007, and D008. The cemented MW is currently being stored at the Central Waste Complex (CWC) at the Hanford Site. DOE-RL is requesting a site-specific variance from the land disposal restrictions (LDR) treatment standards of WAC 173-303-140 because there are no onsite or offsite treatment facilities capable of meeting them for this specific waste form.

Description of Proposed Action

This petition requests a site-specific variance from applicable LDR treatment standards for the cemented MW designated with waste numbers D006, D007, and D008. DOE-RL requests a variance to macroencapsulate the cemented MW in lieu of treating the waste to meet the prescribed concentration-based treatment standards in 40 CFR 268.40 for the three characteristic metals. The cemented MW will be left intact, treated by in-trench macroencapsulation, and

disposed onsite at the Low-Level Burial Grounds (LLBG) Mixed Waste Disposal Units (i.e., Burial Ground 218-W-5 Trenches 31 or 34).

Additional information about this waste and the rationale for this alternative approach to treatment are provided in the following sections.

Statement of Need and Justification for the Proposed Action

DOE-RL proposes that the treatment of the cemented MW to meet the concentration-based LDR treatment standards is inappropriate, and a site-specific variance from the treatment standards is justified. Further information on the need for and justification of the site-specific variance request is described in this section. The waste description and the rationale for using macroencapsulation as an alternative treatment standard for this specific waste are described hereafter.

Waste Description

The cemented MW was originally from Argonne National Laboratory-East (ANL-E), but has been managed at Hanford since the mid 1980s (i.e., is Hanford Legacy MW). The drums of MW were considered suspect transuranic (TRU) waste and were retrievably stored in the LLBG for 23 years. They were retrieved from Burial Ground 218-W-4C covered under the Tri-Party Agreement (TPA) in 2008. This MW is presently defined under the TPA as retrievably stored waste (RSW) and is classified as remote-handled (RH) mixed low-level waste (MLLW) at Hanford.

Waste Generating Process

ANL-E provided a wide variety of analytical support for many different defense and non-defense related programs. The ANL-E Building 200 Hot Cells supported the development of the U.S. Navy's Proof-of-Breeding (POB) program for the light water breeder reactor (LWBR) at Shippingport, Pennsylvania. The POB research was conducted on irradiated ^{232}Th rods used to breed fissile ^{233}U. In the Building 200 Hot Cells, segments were analyzed for total uranium, individual uranium isotopes (^{232}U and ^{233}U), and for certain fission products, the latter to enable a determination of burnup. ANL-E carried out destructive physical, chemical and radiometric analysis on the end-of-life fuel rods. The fuel segments were cut from precisely located positions along a fuel rod by a specially designed shear that simultaneously pulverized the fuel and freed it from the cladding during the shear stroke. All pieces of the original segment were collected in an aluminum sample can and the contents were dissolved in a heated solution of nitric acid and hydrofluoric acid. The dissolver solutions were also analyzed for total uranium and uranium isotope abundances.

Waste Packaging

The waste consists of acidic dissolver solution from ANL-E Building 200 Hot Cells that was neutralized with slaked lime and mixed with Portland cement in 1.5-gal cans to produce solid monoliths. Excess lime was used to ensure neutralization of the acidic dissolver solution. Two primary cans were placed in a secondary steel can and enclosed within a lead cylinder (lead as shielding is 19-67% by weight), which was loaded into a galvanized 55-gallon drum. There are a total of 42 55-gallon drums (8.74 m^3) in the waste stream, including packaging and lead shielding. Each drum contains two primary cans or 3 gallons of neutralized and cemented dissolver solution (i.e., dissolved fuel and metal cladding) for a total of 126 gallons (0.48 m^3) of cemented MLLW.

Radiological Considerations

The $^{232}Th/^{233}U$ materials were irradiated in the Shippingport Reactor where the LWBR studies were being performed for a period of approximately five years. The reactor was shut down in October of 1982. The 42 cemented MLLW drums contain thorium, uranium, and significant quantities of mixed fission products (MFPs). Based on assays conducted in 1985, each of the drums originally contained about 300 curies of MFPs and the primary cans originally had surface dose readings of approximately 250 Rem/hr when generated, hence the lead shielding and special packaging configuration. The MFPs were corrected for the 25 years of radioactive decay and currently each contains about 130 curies of MFPs remaining. The 42 ANL-E drums are RH drums shielded down to contact-handled (CH) status. Average dose readings on the outside shielded packages today are about 16 mrem/hr and they are being managed as CH-MLLW at CWC. However, for any intrusive waste management activities to be conducted they must be considered as RH-MLLW.

Table 1 below summarizes the physical, chemical, and radiological characteristics of the cemented MLLW from ANL-E.

Table 1. Characteristics of ANL-E Cemented MLLW

Parameter	Characteristic
Quantity	126 gallons (0.48 m^3)
Physical Form	Hard Monolithic Solid
Cadmium	1.0 mg/L TCLP (process knowledge)
Chromium	5.0 mg/L TCLP (process knowledge)
Lead	5.0 mg/L TCLP (process knowledge)
Composition	Portland Cement (~50%) Lime (~30%) Dissolver Solution (~20%)
NRC Class	C
Dose Rate (unshielded)	100 Rem/hr at 1 foot 1000 mRem/hr at 1 meter

Waste Codes and LDR Treatment Standards
At the point of generation this waste is non-debris and designates as dangerous waste for the following hazardous waste numbers: D006, D007, and D008. The applicable non-wastewater (NWW) LDR treatment standards for these three characteristic metals are provided in Table 2 below. There are no applicable underlying hazardous constituents (UHCs) associated with this waste stream.

Table 2. Applicable Non-Wastewater LDR Treatment Standards

EPA Hazardous Waste No.	Constituent of Concern	40 CFR 268.40 NWW Treatment Standard
D006	Cadmium	0.11 mg/L TCLP
D007	Chromium	0.60 mg/L TCLP
D008	Lead	0.75 mg/L TCLP

Proposed Alternative Treatment Method
The proposed treatment process is to macroencapsulate the intact waste packages containing the cemented MLLW in Trench 31 or Trench 34 at the LLBG using in-trench immobilization/ macroencapsulation process in accordance with 40 CFR 268.45. The cemented waste form will be left intact in its original packaging configuration in the 55-gallon drums. The 42 drums will be placed on a prepared grout surface in Trenches 31 or 34, forms built around the drums, and flood grouted with cement that will completely encapsulate all of the containers meeting the requirements of 40 CFR 268.45.

Rationale for Using Macroencapsulation Treatment
Macroencapsulation of the cemented MLLW in accordance with 40 CFR 268.45 and as described above does not meet the applicable concentration based treatment standards listed above in Table 2. The cemented MLLW is non-debris and alternative debris treatment standards do not apply. The Best Demonstrated Available Technology (BDAT) used to meet the concentration based treatment standards for this type of waste is stabilization with a suitable stabilizing agent as discussed below.

The BDAT for treatment of this type of cemented MLLW is stabilization of the characteristic metals at a RCRA permitted treatment facility. The typical stabilization treatment includes collecting a presample to determine treatment parameters and reagents, treatment via stabilization with the appropriate reagents (e.g., Portland cement, lime, fly ash, cement kiln dust), waste form curing, confirmation sampling to ensure the applicable concentration based treatment standards are not exceeded, and disposal of the LDR compliant treated waste in a RCRA Subtitle C landfill such as the LLBG MWDUs. If the analytical results fail for any constituent of concern, the treatment process is repeated until the final waste form meets all applicable treatment standards. Stabilization of the cemented RH-MLLW will involve multiple intrusive steps as described above.

The radiological and physical characteristics of the cemented MLLW prevent it from undergoing such treatment. Treatment to the specified levels in the 40 CFR 268.40 concentration based

standards is technically inappropriate because it poses a greater risk to human health and the environment as compared to the proposed alternative treatment method of in-trench macroencapsulation. DOE-RL believes the concentration based treatment standards are inappropriate for the following reasons:

1. No Treatment Capacity – There is no onsite or offsite treatment capacity for this RH-MLLW. There are currently no onsite treatment options for this waste stream. At Hanford, there are hot cell facilities operating, but none that can manage this specific waste form. Other DOE facilities with remote handling capabilities, such as the Advanced Mixed Waste Treatment Project Facility at the Idaho National Laboratory, were evaluated but they cannot manage this specific waste from either. A new remote handling facility would be required to perform stabilization of this waste form. This facility would need to have remote handling equipment to core and/or pulverize the cemented RH-MLLW. It would also have to be RCRA permitted to conduct the treatment. Current priorities and funding forecasts at Hanford would push the construction of a new multi-year and multi-million dollar facility out many years.

   There are several offsite MW treatment facilities capable of performing the stabilization on lower activity waste streams, but not for this highly radioactive waste stream. Radiological license limits for offsite treatment facilities would prohibit this waste from being accepted, primarily due to high $^{137}Cs/^{90}Sr$ activities and associated dose. For example, the Perma-Fix Northwest (PFNW) MW Treatment Facility in Richland, Washington does the vast majority of stabilization for MW from Hanford, but their radiological license limit for ^{90}Sr is 25 curies for the total facility inventory. Each of the 42 drums contains an average of 59 Ci of ^{90}Sr alone, more than doubling their facility limit and prohibiting us from sending them the waste for treatment. Other offsite treatment facilities, such as Perma-Fix's Oak Ridge, Tennessee MW Facility or EnergySolutions' Clive, Utah MW Facility, have similar or more restrictive radiological limits.

2. High Dose Exposure Risks - Treatment of the cemented waste stream will require intrusive activities to sample, prepare, and treat the cemented waste form. This would pose an increased hazard to treatment facility and laboratory personnel. Unshielded dose rates were evaluated using Microshield software and although lower than when the waste was first generated, they are still too high for manual work outside of a hot cell type environment, which does not currently exist for this type of treatment process. The estimated dose rate at 30 cm is nominally 100 rem/hr, exceeding the annual dose limit either for the extremity or for the skin specified in 10 CFR 835.202(a)(4) in under an hour. Without engineering controls, such a dose could lead to injurious acute whole-body exposure within a few hours. Stabilization would pose a greater hazard to human health than the proposed alternative treatment of in-trench macroencapsulation.

3. Generator Treatment - The waste was generated prior to promulgation of the treatment standards for the characteristic metals. When ANL-E generated the waste in the early 1980's they prepared the waste for disposal in the Waste Isolation Pilot Plant (WIPP) per criteria at the time; however, the WIPP was not fully permitted yet and unable to receive the waste. Hence, the need for retrievable storage in 218-W-4C at Hanford. The definition of TRU waste changed over the years, as did WIPP's acceptance criteria. The waste contains no TRU isotopes; therefore WIPP is no longer an option for this RH-MLLW.

   In essence, ANL-E performed generator treatment and stabilized the dissolver solution in the same manner a treatment facility would do so today (i.e., neutralization/stabilization with lime/Portland cement). Portland cement has been demonstrated as an effective stabilization reagent for cadmium, chromium, and lead. DOE-RL believes the waste is already in a stabilized waste form and should not be disturbed, unfortunately ANL-E was under no regulatory obligation at the time to analyze and certify the waste for LDR compliance. It would be counterproductive to damage a waste form that is essentially the same as a treated waste form using the current BDAT today.

For these reasons, DOE-RL believes it is technically inappropriate to treat the RH-MLLW per the concentration based standards of 40 CFR 268.40. Instead, DOE-RL proposes treating the RH-MLLW by the alternative treatment standard of macroencapsulation per 40 CFR 268.45. The rationale for this determination is described below.

Macroencapsulation as the Alternative Treatment Standard

DOE-RL believes that using the alternative treatment standard of macroencapsulation is more protective of human health and the environment. In-trench macroencapsulation per 40 CFR 268.45 is specifically called out in the Dangerous Waste Permit Application Part A Form for the LLBG as an acceptable treatment option for MLLW debris. DOE-RL has already demonstrated that in-trench macroencapsulation can be performed in MWDUs for intact containers of debris. Using in-trench macroencapsulation as an alternative treatment standard for this specific waste stream is the best option for the following reasons:

1. Onsite Treatment Capability – There are no onsite facilities capable of treating or sampling this highly radioactive waste to meet 40 CFR 268.40 treatment standards. There are offsite facilities capable of treating waste streams like this by stabilization to meet the applicable treatment standards, however, there are none that can accept or treat waste with the radiological characteristics of the cemented MLLW. Onsite capability to treat this waste stream as proposed by the alternative treatment standard of macroencapsulation per 40 CFR 268.45 is available and fully operational.

2. No Offsite Transportation Required – If offsite treatment capabilities were available, transportation would be required on public roads increasing the risks associated with those activities. It is estimated that a minimum of 6 separate shipments would be required to transport the 42 drums to a potential offsite treatment facility, if available. By conducting in-trench macroencapsulation as proposed there would be no need for offsite transportation of the waste. The waste is being stored at CWC, which is adjacent to the

MWDUs and requires minimal drum movements to place them for in-trench macroencapsulation.

3. Lower Doses to Affected Workers – Treatment by the BDAT would require intrusive activities to be performed for LDR compliance increasing exposures to workers. The in-trench macroencapsulation option would result in less exposure to workers because the only drum handling would be transferring the fully shielded containers (i.e., no intrusive activities) from CWC to the MWDUs.

4. Similar to Other Radioactive Treatment Standards – Other waste subcategories with characteristic metals have specific or alternative technology based treatment standards using macroencapsulation. One of the alternative treatment standards for debris per 40 CFR 268.45 is macroencapsulation, which is very effective for treating MLLW with characteristic metals such as cadmium, chromium, and lead. The treatment standard for radioactive lead solids is macroencapsulation per 40 CFR 268.40. Radioactively contaminated cadmium containing batteries also have macroencapsulation per 40 CFR 268.45 as the specific treatment standard since they are like debris and cannot be easily recycled. Macroencapsulation is the best option for radiologically contaminated debris-like waste with RCRA metals that cannot be easily sampled or recycled. This site specific waste stream is similar in that it is solid and cannot easily be treated or sampled due to its radiological characteristics. There has been some precedence for using this logic at Hanford by using the alternative treatment standard of macroencapsulation for non-debris waste containing barium.

5. Increased Protection of the Environment – It could be argued that the current waste form already meets the requirement for stabilization (see discussion for generator treatment above). By performing in-trench macroencapsulation on the intact cemented MLLW, an additional layer of protection against infiltration of precipitation to the waste and leaching from the waste through the ground would be provided. The waste containers will be completely encased in a grout monolith meeting the requirements of 40 CFR 268.45. In addition, this treatment and disposal will be completed in the MWDUs (Trenches 31 or 34) at the LLBG, which is a lined RCRA Subtitle C landfill.

For these reasons, DOE-RL believes the proposed alternative treatment standard of macroencapsulation per 40 CFR 268.45 is more protective of human health and the environment, and therefore should be the new treatment standard for this one-time, site-specific waste stream.

Certification

The following certification is made in accordance with WAC 173-303-910:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signature of petitioner: